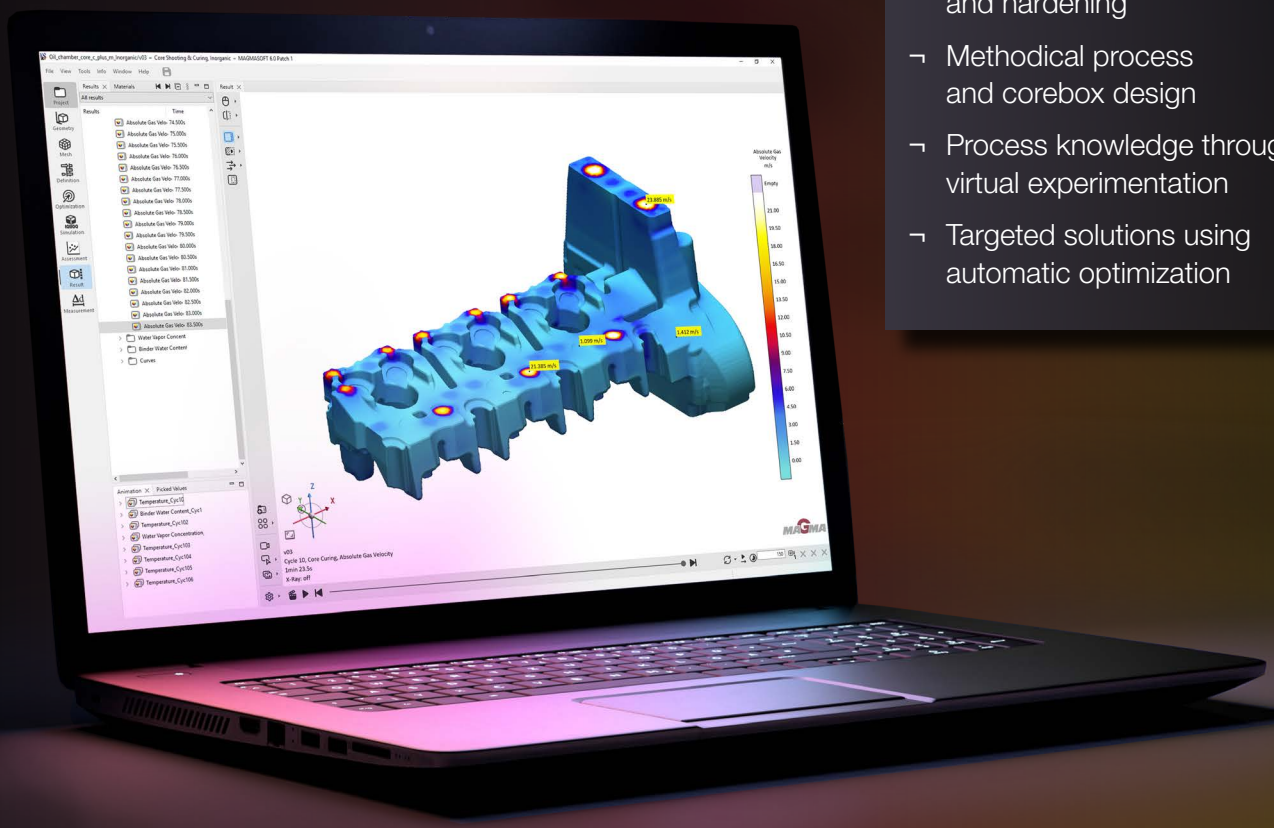
MAGMA C+M 6.0

Autonomous Engineering

Coremaking

- Robust solutions for core shooting and hardening
- Methodical process and corebox design
- Process knowledge through virtual experimentation
- Targeted solutions using automatic optimization



Robust, Economical, Fast, **Optimized**

Optimize all aspects of coremaking and find the best solution for your requirements — with MAGMASOFT® autonomous engineering and MAGMA C+M.

MAGMASOFT® and the dedicated turn-key solution MAGMAC+M are comprehensive and powerful simulation software tools for all aspects around designing and improving core quality, tooling design and robust process conditions while ensuring optimal profitability by saving resources, time and costs.

With both, MAGMASOFT® and MAGMA C+M, you use simulations in an automated virtual design of experiments or genetic optimization. The result is Autonomous Engineering – systematic and fully automated decision-making for corebox concepts and coremaking.

With Autonomous Engineering, you can simultaneously pursue different quality and cost objectives. From securing core quality and process robustness at the concept stage, through final corebox design and the continuous improvement of profitability in series production.

MAGMASOFT® autonomous engineering and MAGMA C+M:

- Support you in the comprehensive prediction of all process steps in coremaking.
- Offer you a virtual test environment for the reduction of core defects.
- Enable you to make quick decisions and save time for all parties involved.
- Allow proactive quality management by understanding process fluctuations.
- Improve communication and cooperation within your organization and with customers.

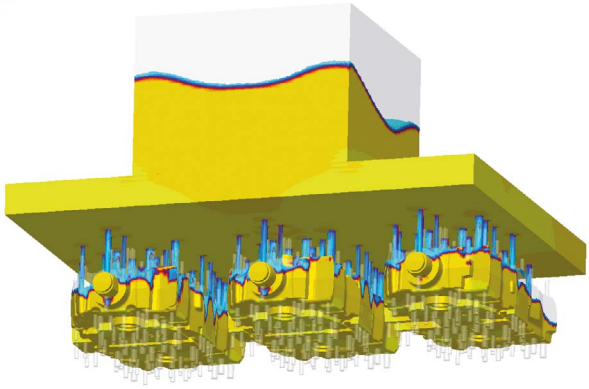
Targeted and Systematic Success

The MAGMA APPROACH, which is fully integrated in MAGMASOFT® and MAGMA C+M, is a systematic methodology for achieving your objectives using virtual experiments. In combination with MAGMASOFT® autonomous engineering, secured measures can be identified and implemented to achieve continuous improvements, without economic risks.

The MAGMA APPROACH supports you at every stage of the product development or improvement process, through a systematic methodology. The result is a robust coremaking process that is optimally designed for the desired objectives, to prevent core defects during core hardening and hardening or through unsatisfactory corebox thermal control.

Set Your **Objectives**, Define Your **Variables**, Specify Your **Criteria**

Identifying and evaluating defect root causes



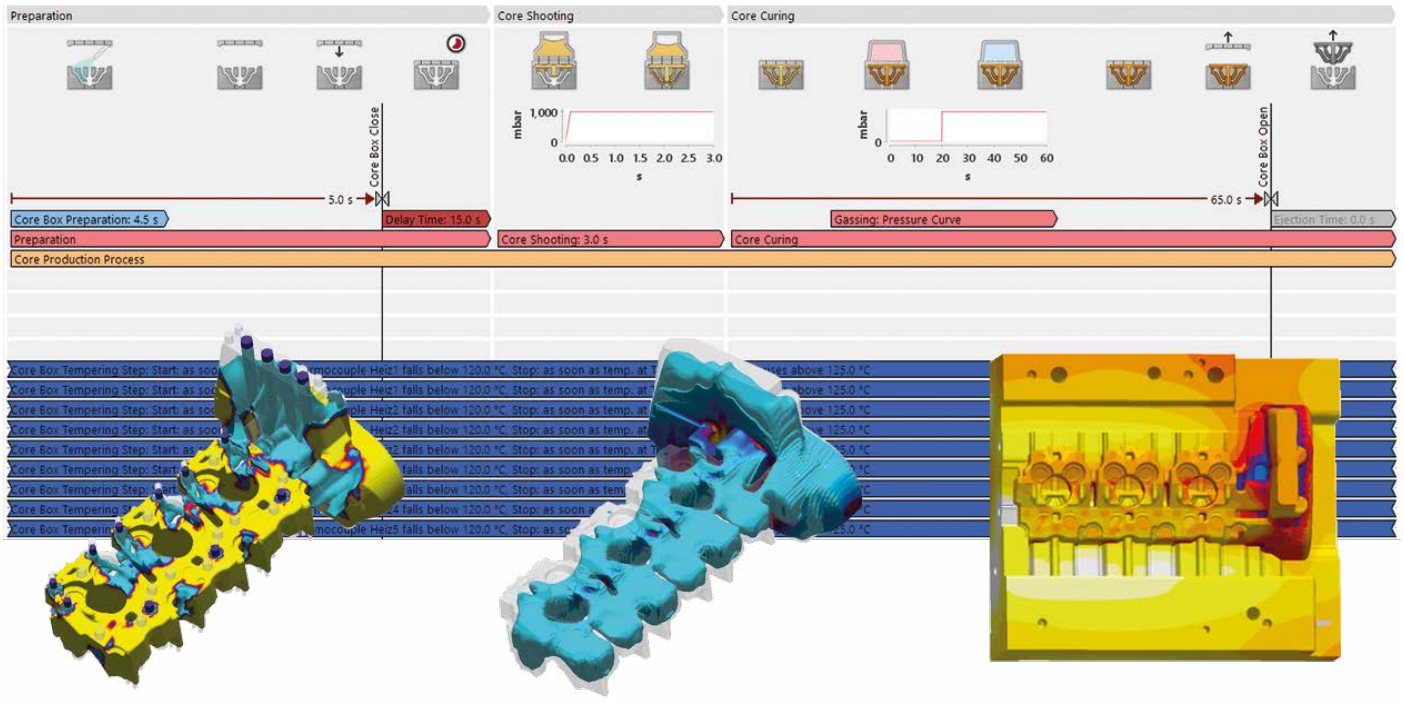
Corebox filling including the hopper for a multiple cavity tool

Shooting – Hardening – Thermal Control

Core shooting and hardening are at the center of the coremaking process. Dependent on the sand-binder system, corebox thermal control is also critical.

Take advantage of the capabilities for analyzing and evaluating each process step in detail separately, for considering the complete process comprehensively.

Depending on the complexity of a new core, you experience each new situation as a challenge. Evaluate up front how to best reach your objectives and avoid unexpected surprises.



Visualization of the entire process chain for core shooting – hardening – temperature control

Core Shooting

Planning in coremaking always begins with an initial proposal for the design of the corebox. Use MAGMA C+M to check your design.

The intuitive MAGMA C+M user interface allows you to quickly prepare the required geometry, whether you are importing CAD data or creating parametric models within the software.

Evaluate and optimize the core geometry and the positioning of the shoot nozzles and vents for questions such as:

- How are different areas of the corebox filled?
- Is the core sand sufficiently compacted?
- What influence do the number, type and position of the shoot nozzles have on the local core density?
- How well can the corebox be exhausted?
- Which parameters have the most significant influence on the core quality?

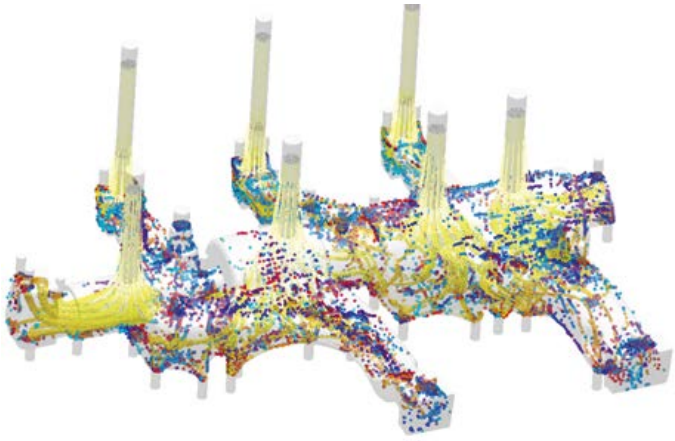
Filling sequence for core shooting

Supplement your knowledge and experience with quantitative process information to evaluate behavior that cannot be seen in practice. Identify possible sources of defects to avoid problems confidently.

Robust and cost-effective coreboxes can be designed taking advantage of various results for the flow of air and sand:

- Sand density or pressure
- Flow vectors
- Flow velocities and sand or air particle movement

Evaluate effects such as corebox wear using dedicated criteria.

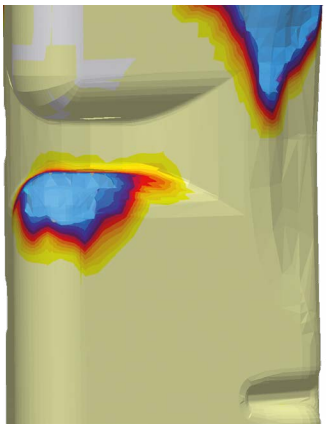


Sand tracers: visualization of air and sand flow

With the help of automated parameter studies, you can optimize core quality in a targeted manner, by varying typical process variables individually or in combination.

Systematically vary nozzle geometries or types and their positions, in order to evaluate the likelihood of process fluctuations causing defects in production. Effects such as fouling of the tooling or varying sand properties can be taken into account.

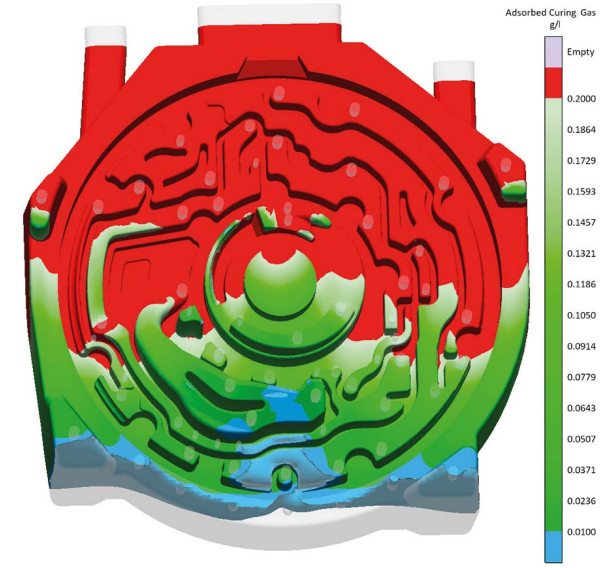
Analysis of sand origin and filled volume for individual shoot nozzles



Identify root causes of core defects

Core Hardening

MAGMA C+M allows the calculation of hardening for all common binder systems. In gas-cured binders, the control of the temperature- and pressure-dependent gas flow is decisive for effective hardening.

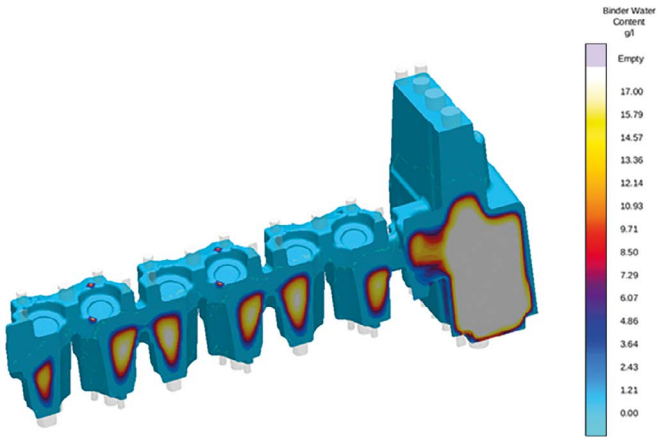


Cold box: amine concentration in the core

When using cold box systems, evaluate how and whether you can move amine into all core areas in a short time. Use the automated variation of nozzle positions and process parameters to minimize cycle times and amine consumption.

For inorganic binder systems, the water in the binder must be effectively driven from the binder and removed from the core. The evaporation of water, the transport of water vapor as well as its condensation during cooling can all be calculated.

This shows you whether the core can be sufficiently dried and hardened within the desired curing time. You avoid condensation zones in areas where the core is subjected to mechanical forces during removal.



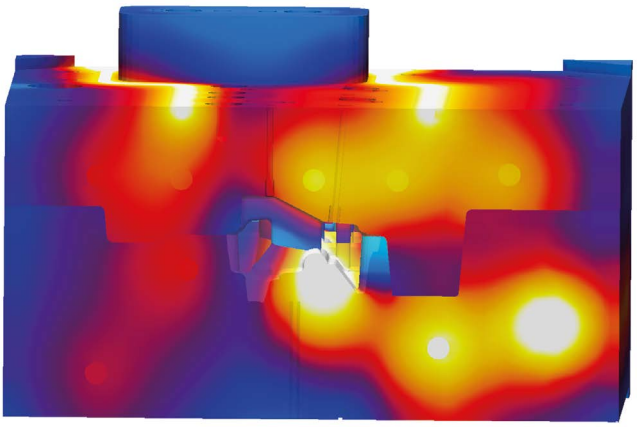
Inorganic binders: evaluate drying and condensation zones effectively

Based on the simulation results, decide whether vents are positioned correctly. Vary pressures, temperatures, vent types, sizes and positions automatically to minimize cycle times.

The optimum nozzle configurations for core shooting and an effective gassing are usually different. Determine which changes you can make from shooting to gassing. The software runs through all variations autonomously and you can evaluate the results.

Corebox Thermal Control

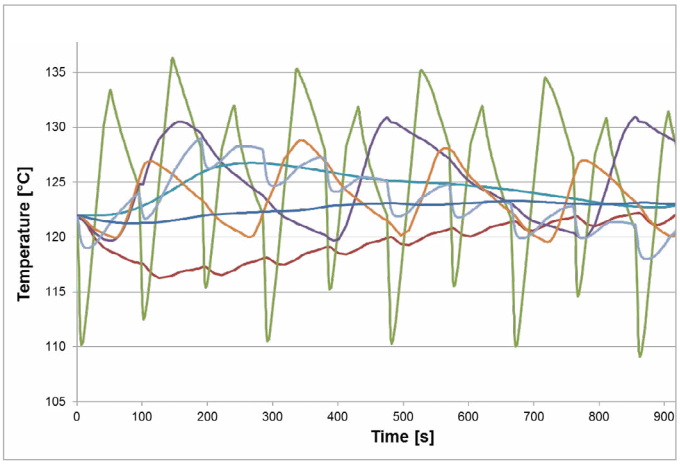
All thermosetting binders require heated tooling. Whether you use oil or electrically heated coreboxes, the thermal design is a challenge. Position heating devices in the mold based on your degrees of freedom in design.



Temperature distribution in the heated corebox

Evaluate the temperature field in cyclic operation. Temperature curves at any selected location document whether the required temperatures can be guaranteed in continuous operation.

How effective is the thermal control? Test your degrees of freedom automatically and identify a robust and optimum thermal design for your corebox.

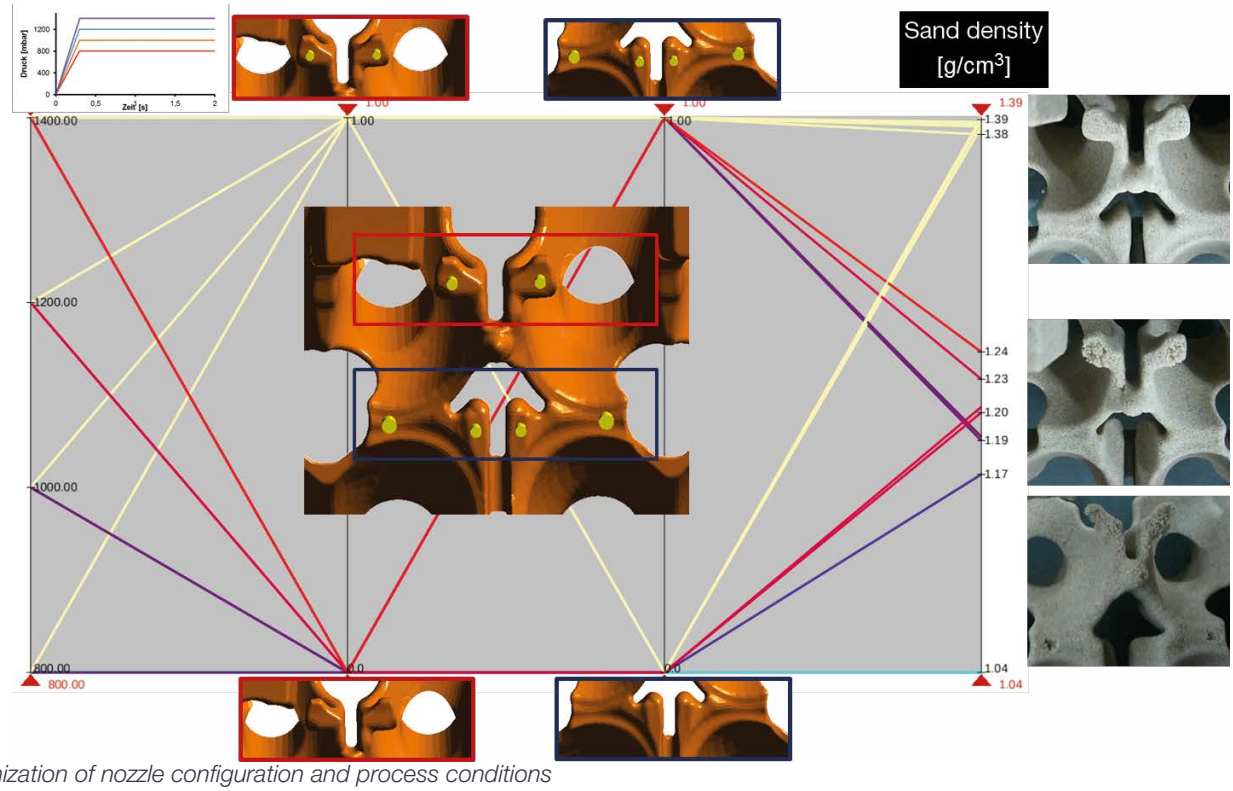


Temperature variation over 10 cycles

The Robust Process

Do unforeseen problems occur repeatedly in coremaking? The systematic variation of, for example, vents avoids time-consuming and cost-intensive testing on the machine. MAGMA C+M shows you the solutions that lead to a robust core production.

Evaluate possible production risks already up front at the corebox design stage and produce good cores from the start.

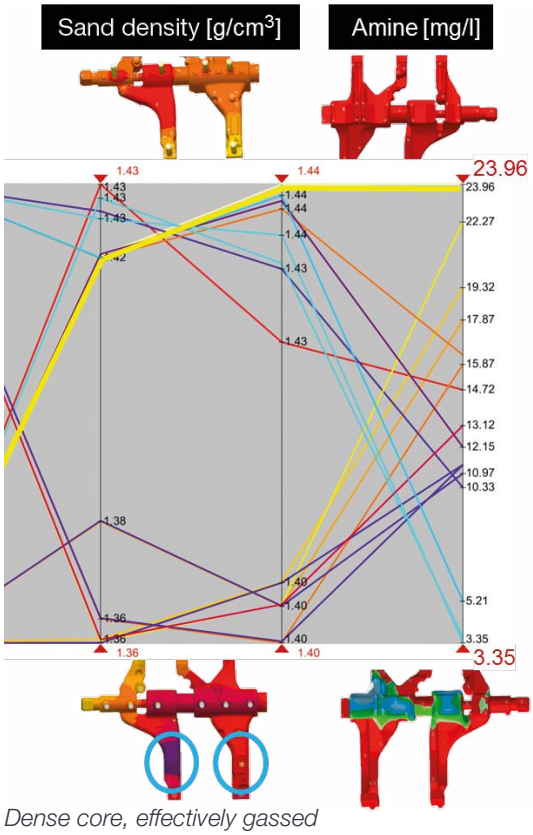


Optimization of nozzle configuration and process conditions

The Best Compromise

The requirements on corebox design for core shooting and hardening are different. What is the best solution for both process steps?

To find the best compromise, simply define your objectives for both process steps. Formulate your degrees of freedom and specify the variable parameters. An autonomous optimization calculates all combinations and evaluates the results.



Dense core, effectively gassed

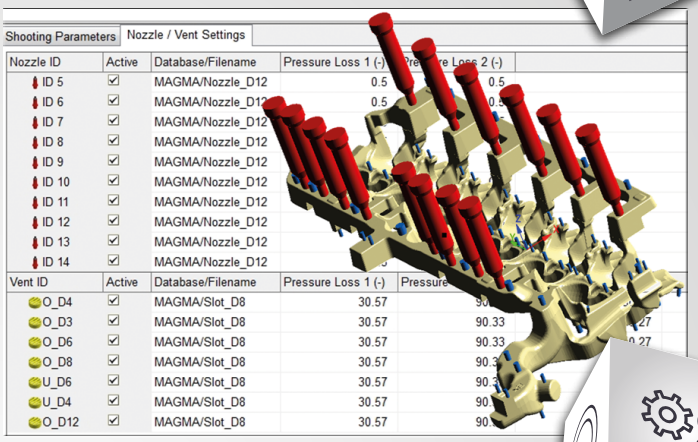
Work **Efficiently** and **Systematically**

Your time is limited! To achieve your goals, it is crucial to systematically and efficiently utilize all the available possibilities in MAGMASOFT®'s comprehensive toolbox.

Assisted Modeling

Versatile wizards and convenient CAD functions support you in targeted and effective model preparation and enable a short time to answer with minimum effort.

Use the practice-oriented visualization of all relevant process steps for optimization of the entire process. Is your focus on core shooting, hardening or corebox thermal control? Consider the process steps separately or combine them as needed.



Act & Check Your **Improvements**

Success is more than software and hardware. MAGMA's professional team is ready to comprehensively support you in realizing your goals. You can take advantage of the services of our MAGMAacademy, engineering and support teams when and how it suits you, and all from a single source.

Implementation

All MAGMASOFT® programs are more than just software. They offer a methodology for optimizing engineering, communication and profitability in your organization.

Even before starting with our software, we will take the time to discuss with you the most important factors to ensure an effective and secured use of our tools based on your situation: from the required computer hardware through the qualification and training of users, to jointly defining objectives regarding where you want to be in the next year.

Whether you are a new customer or a long-time user of our software: We have plans with you!

MAGMAsupport

MAGMAsupport stands for the competent, methodical and fast support of our customers worldwide regarding all questions in the application of and problem-solving with our products. With the MAGMA APPROACH, our qualified support staff will help you to make better use of our software every day.

MAGMAacademy

The MAGMAacademy systematically supports you in the implementation of both casting process and virtual optimization, from the initial rollout to the comprehensive application of Autonomous Engineering throughout the entire organization.

In our training courses, workshops and seminars, we convey interdisciplinary understanding across all processes and departments for the best possible use of MAGMASOFT® – conducted at our offices or through a customized solution on-site.

MAGMAengineering

As an independent and competent partner, MAGMAengineering supports a successful virtual product development, tooling design and optimization of your robust foundry processes within the framework of engineering projects.

An interdisciplinary and international team of experts, with numerous years of casting expertise, is available to work with you using MAGMASOFT® autonomous engineering to address your challenges.

Casting Knowledge.
In a Software.

MAGMASOFT® 6.0

MAGMASOFT®
autonomous engineering

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